

RESTRICTED

TM 5-267

WAR DEPARTMENT

TECHNICAL MANUAL

CAMOUFLAGE

May 1, 1943

CAMOUFLAGE



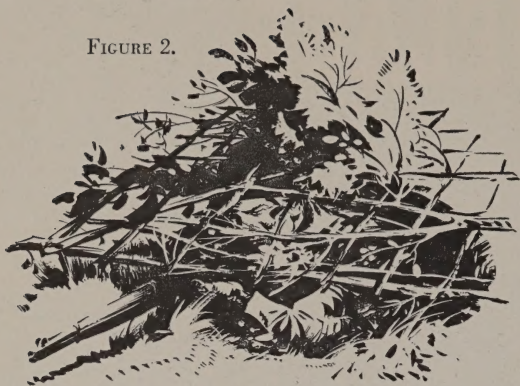
FIGURE 1.—Men working on P-43 under concealment. Flat-top is supplemented by palm leaves over star and blankets over cockpit windshield and canopy.

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FIGURE 2.



The Mission of **TM 5-267**

This is the basic volume of a technical manual to be published in several parts. Supplements will appear at frequent intervals, with latest information on camouflage materials and techniques, selected for interest to the using troops.

CAMOUFLAGE, TM 5-267, is designed to meet the needs of troops in the Army Ground Forces, the Army Air Forces, and the Army Service Forces. It fulfills a definite military purpose—and an important one.

All experienced troops know *why* camouflage is necessary, but the *how* is a different matter. Unlike many other military activities, camouflage has no civilian counterpart in peacetime. Moreover, there is no single way to conceal a military installation. Methods used must vary with the terrain, the materials available, and the time of year. Though the basic principles of camouflage do not change, development of new techniques and materials proceeds continually. Even those men who have received special camouflage training must be kept informed of the new methods of achieving protective concealment, in order to obtain concealment with minimum expenditure of time and materials.

Information sent in from the field, and the findings of the agencies engaged in camouflage and development will be prominent in this series of publications. Such information will be useful to the camouflage specialist. It is prepared for enlisted men and junior officers of the combat arms. Wide use of this information will assist in meeting training objectives.

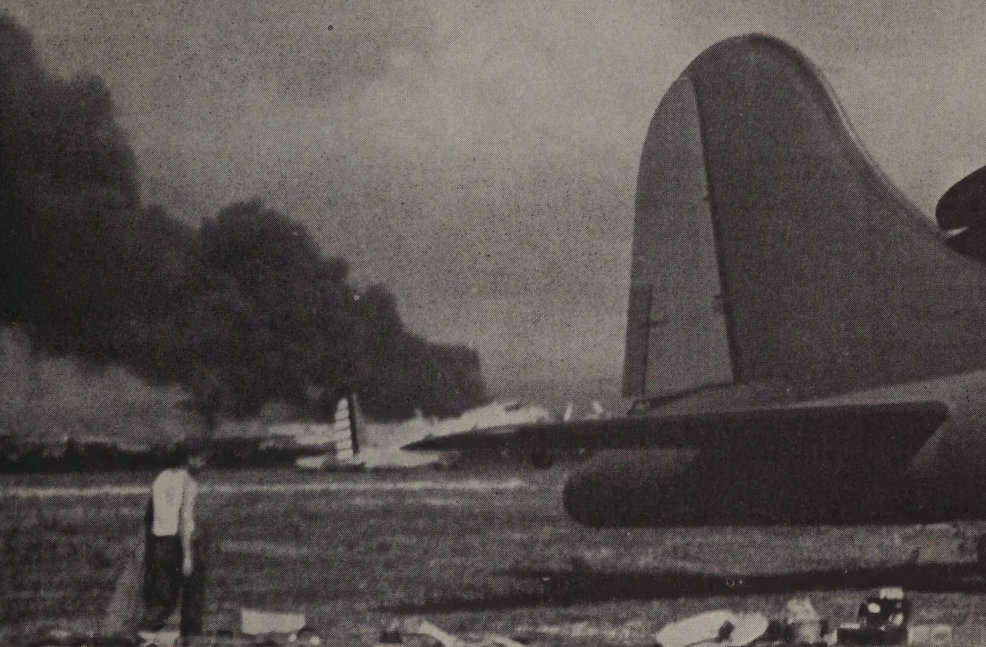
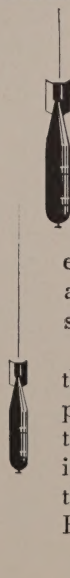


FIGURE 3.

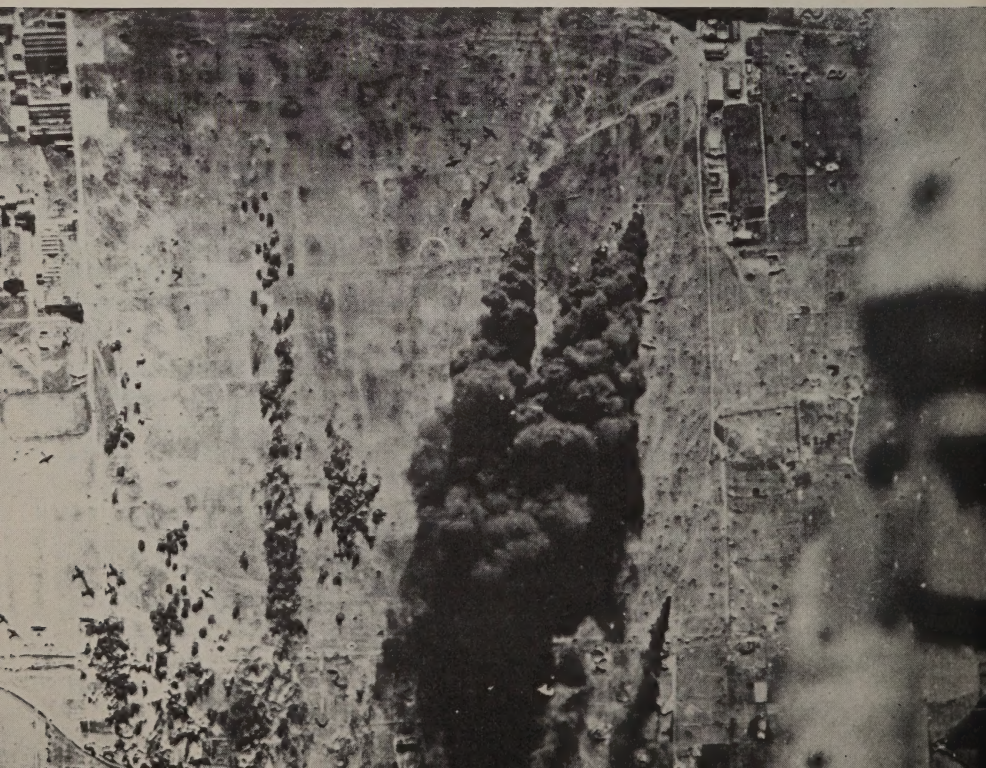
CAMOUFLAGE of AIRCRAFT on the GROUND

Planes on the ground are vital and easy targets of air attack and must be camouflaged. Even the most complete camouflage of a field is not enough if planes can be seen.



Enemy planes usually come over our airdromes with but two purposes—to obtain information about them and to attack them. The first is primarily a forerunner of the second, though whatever the enemy can learn about an airdrome also contributes much to his strategic plans.

The better an airdrome is concealed, the easier it is to conceal individual planes there. If the enemy cannot see the field at all or if its appearance is obscured, the attack force can neither find nor aim at point targets. However, it is seldom, at least in for-



ward areas, that camouflage can approach complete concealment of a whole field. Camouflage of planes on the ground must start with the assumption that the location of the airdrome will be known to the enemy.

DISPERSION—The most important measure that can be taken to protect individual planes on the ground is dispersion. The destruction of planes is practically assured by putting them together under one roof or in one parking area. Dispersion not only materially reduces bomb destruction, but also provides better concealment possibilities for each plane. Planes should be parked on the edge of landing areas or in adjacent fields, always making use of available natural concealment. If possible, dispersal points should be at the edges of wooded areas and should face in various directions. Sometimes thin concealment can be well augmented by transplanting small trees or by planting quick-growing vines, particularly when time permits and cuttings are available. However, terrain features and appearances should be left unchanged in appearance.

In dispersing bomber and observation planes, the ability to take to the air rapidly is not as important a consideration as it is for pursuit planes. Accordingly, the former may well be dispersed at some distance from the airdrome. There are situations where

several miles would not be excessive. It depends partly on the need for protecting dispersed aircraft from sabotage, and also on accessibility for maintenance and operation.

UTILIZING THE TERRAIN FEATURES—Even open terrain offers some possibilities for concealment. Shadows are least conspicuous to the aerial observer when they fall on such uneven and irregular surfaces as rock piles, broken ground, and brush. Planes should be parked close to small hills and knolls where their visibility is materially reduced by the ground forms. When it is decided to use nets, drapes, or artificial materials, these should also be in close relation to sloping ground forms or vegetation.

Folds in the ground, hedges, rock outcrops, multicolored vegetation, or patches of rough ground should all be utilized in the concealment of aircraft. It is a simple and effective expedient, for example, to place aircraft so that the wing shadows—the easiest pattern to recognize—are superimposed on well-defined ground features with straight edges, such as hedgerows, stone walls, or even the boundaries of adjacent fields.

Every effort should be made to select ground which most nearly blends with the color of the upper surfaces of planes. Aircraft painted dark green or olive drab are far less noticeable in a field of low green shrubbery than in yellow wheat stubble.

NATURAL CONCEALMENT—The proper use of natural concealment should be familiar to every soldier from basic training. Principles of concealing aircraft differ little from those which concern the individual.

In heavily-wooded areas even the largest planes may be well hidden. Natural overhead concealment is the

FIGURE 4.—Progress pictures (a) and (b) of an Allied raid on a German field in North Africa. Planes exposed in the open are as distinct as stars on a flag. The closer together they park, the fatter the prize for a single bomb hit.



most satisfactory for aircraft on ground. It is of the utmost importance that it be carefully preserved. Pursuit ships and other small aircraft can be backed into the edges of any wooded area, with a minimum of clearing to accommodate the tail and fuselage. When the front of the plane is screened with nets, drapes, or cut foliage, effective concealment is afforded. Bombers are more difficult to hide in this manner because of their size: concealment requires careful preparations and use of a larger quantity of artificial materials.

FLAT-TOPS AND NETS—Flat-tops of chicken wire or twine netting, garnished with natural or false materials, and supported parallel to the ground on a raised wire frame, may be used in many ways to conceal planes. The effectiveness of natural concealment may be extended by them. Where the concealment is especially thin, flat-tops are a necessity for protection against aerial observation.

In irregular terrain flat-tops are particularly effective to hide small aircraft. A flat-top over a small plane can be kept comparatively low. Built to be consistent with local terrain features, colored properly, and well-maintained, flat-tops will always be a protection. The more open the area, however, the more difficult it is to blend flat-tops into the terrain.

Flat-tops for aircraft are generally larger than those used for other purposes; therein lies the greatest difficulty in their construction and maintenance. To reduce heavy shadows and defeat oblique observation, flat-tops may require terracing on three sides and drapes to hide the front. A new type of flat-top, designed to eliminate revealing oblique shadows, is built with its sides sloped gently to the ground. While this flat-top is designed for a pursuit ship, the principles involved may be modified for other needs. However, even this flat-top is likely to be detected by careful analysis of aerial photographs.

FIGURE 5.—*A circulating taxiway system like this provides an alternate route to runways, should one be cut off. The hard standings should be situated under trees when possible.*



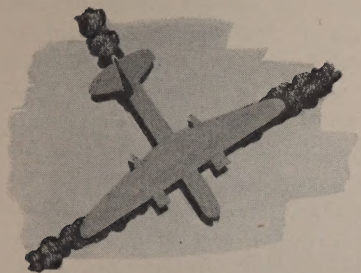


FIGURE 6.—A plane is less visible if placed on the junction of lines which are natural in a landscape—as hedge-row lines.

FIGURE 7.

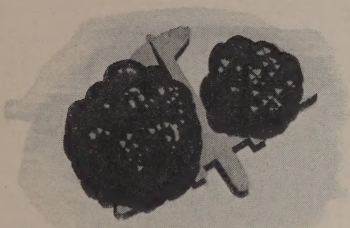


FIGURE 8.—A few trees can give good concealment when a plane hides in their shade.

FIGURE 9.

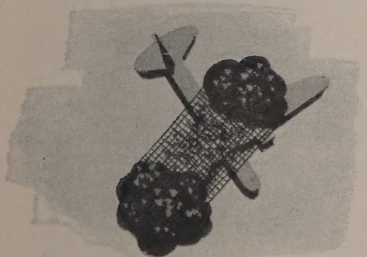


FIGURE 10.—When the open spaces between trees are excessive, enlarge the overhead concealment by adding flat-tops suitably garnished.

FIGURE 11.



DRAPES—When garnished camouflage nets or the new shrimp nets (see “Nets and Netting,” page 27) are drawn completely over planes as drapes, care must be exercised to prevent injury to control surfaces, airdials and radio connections, gun mountings, and pitot tubes. To avoid breaking the aerial of a P-38, for example, a firm support must be placed to hold the drape.

Drapes for aircraft should provide openings with some sort of slip-knot tie system, such as the dutch or circus hitch, to permit the ship to be serviced without removing the entire drape. Slits should be provided for engine maintenance, for armament maintenance, and for the pilot to get into his cockpit and at his gear. To prevent persons who do not know where the slits are, or who will not

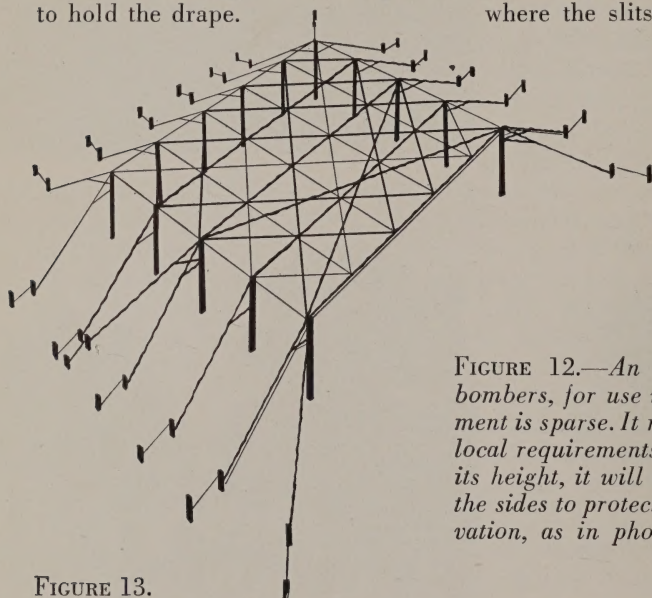
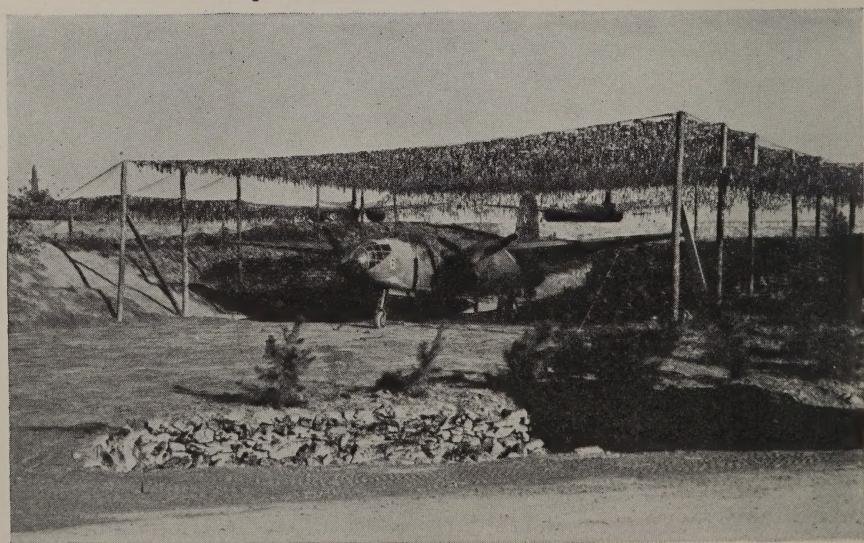


FIGURE 13.

FIGURE 12.—An elaborate flat-top for bombers, for use where natural concealment is sparse. It may be modified to suit local requirements. In open areas, due to its height, it will need to be terraced on the sides to protect it from oblique observation, as in photograph below.



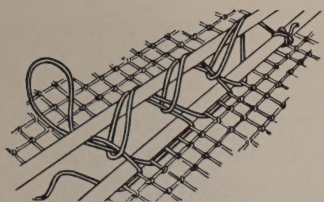


FIGURE 14.—*Quick-opening tie.*

take the trouble to find out, from attacking this problem with a pocket-knife when no one is looking, operat-

ing instructions should be attached to the drape where the person cannot fail to see them.

Fair concealment is afforded in this way if the draped plane is properly sited with reference to the terrain. Tests are being conducted to develop standard drapes for the various types of planes. A drape gives incomplete concealment to the plane's form, unless great care is taken to draw the

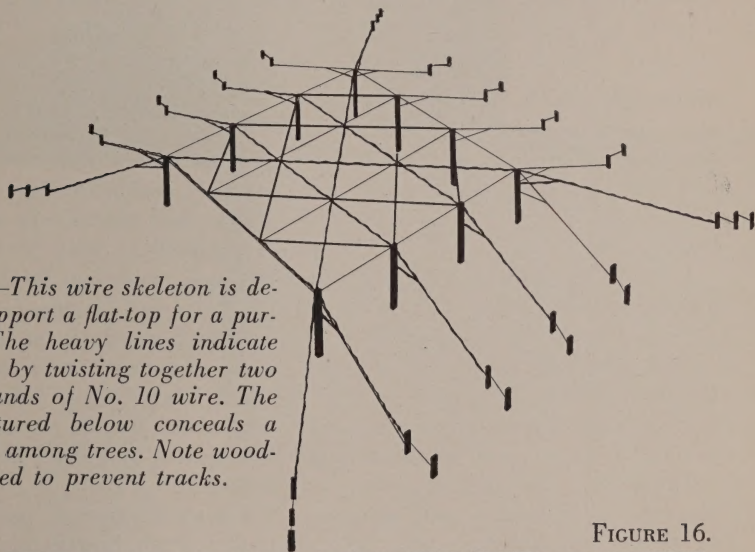


FIGURE 15.—*This wire skeleton is designed to support a flat-top for a pursuit ship. The heavy lines indicate cables made by twisting together two or more strands of No. 10 wire. The flat-top pictured below conceals a P-40 parked among trees. Note wooden ramps used to prevent tracks.*

FIGURE 16.



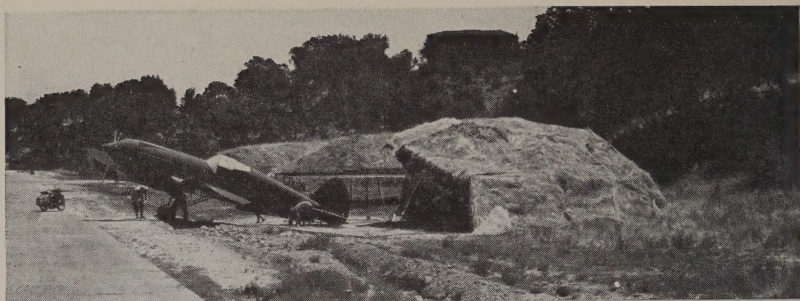


FIGURE 17.—A “hide” of garnished chicken wire simulating a haystack.

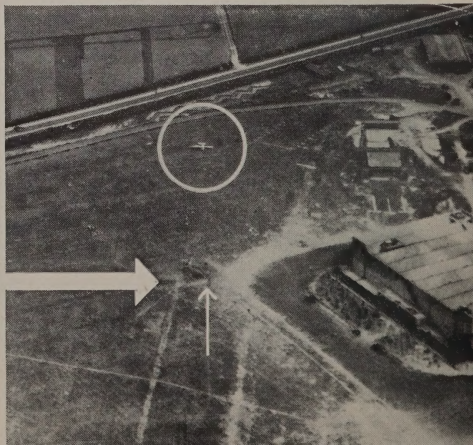
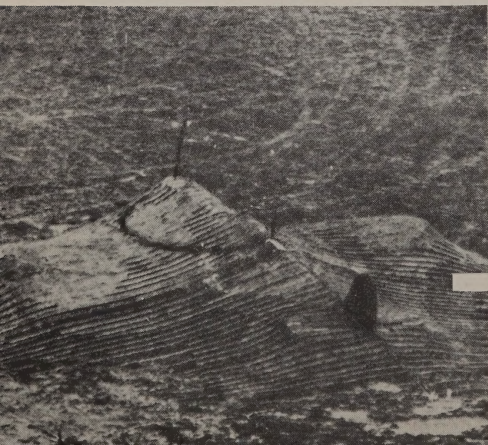
drape tight and away from the plane, allowing it to touch in as few places as possible. This takes time, however, and if the plane must get into the air quickly the drape is cumbersome to handle.

In addition to using standard camouflage materials for drapes, there are many other ways to construct concealed positions (aircraft “hides”). Frames made of chicken wire to support garnished netting may be used to simulate or continue natural terrain irregularities. To reduce, alter, or eliminate the characteristic shadows of the wings and fuselage, netting

may be attached underneath and sloped to the ground. A number of unjointed, unevenly-torn lengths of colored osnaburg (a cheap cotton fabric used extensively as a garnishing material) may serve the same purpose. They can be thrown across the wings and fuselage, and should be stretched at different angles from each other and from the part over which they hang. Many original treatments may be worked out using this system of partial but rapid concealment.

Dispersed aircraft cannot be concealed from hostile observation by

FIGURE 18. ① and ②.—In the circle is an exposed plane. Even from a high altitude it could not be mistaken. Compare it with that bump on the ground—which is a plane covered with a garnished drape.



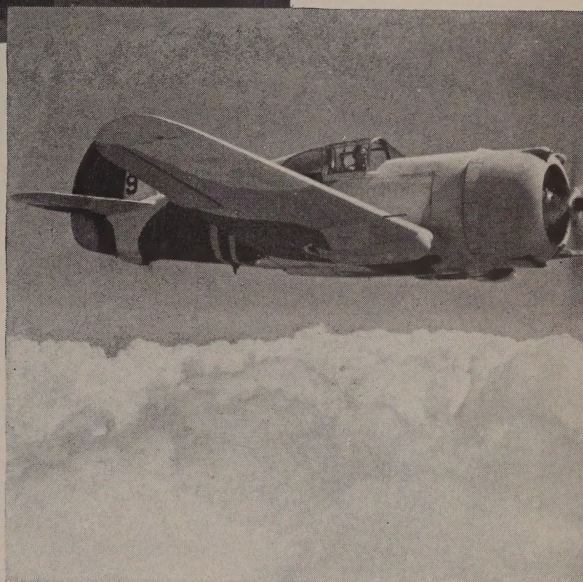
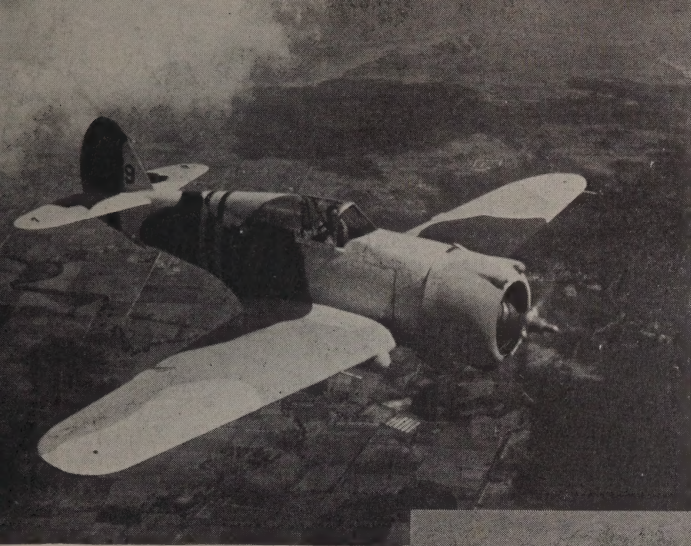
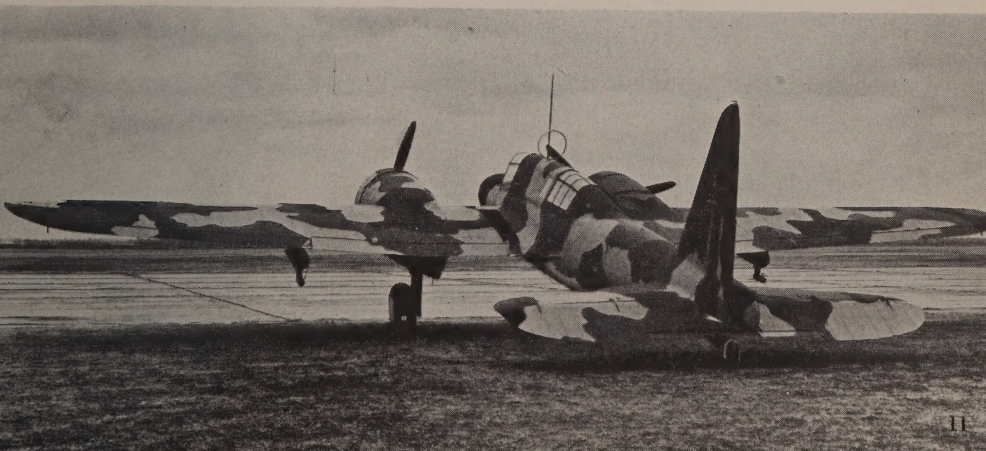


FIGURE 19. ①, ② and ③.
—Whether or not planes
will be pattern-painted in
the field is a command de-
cision. As a general policy,
patterns will be used only
for special purposes or in
certain localities. In color
and form they should
match the terrain.



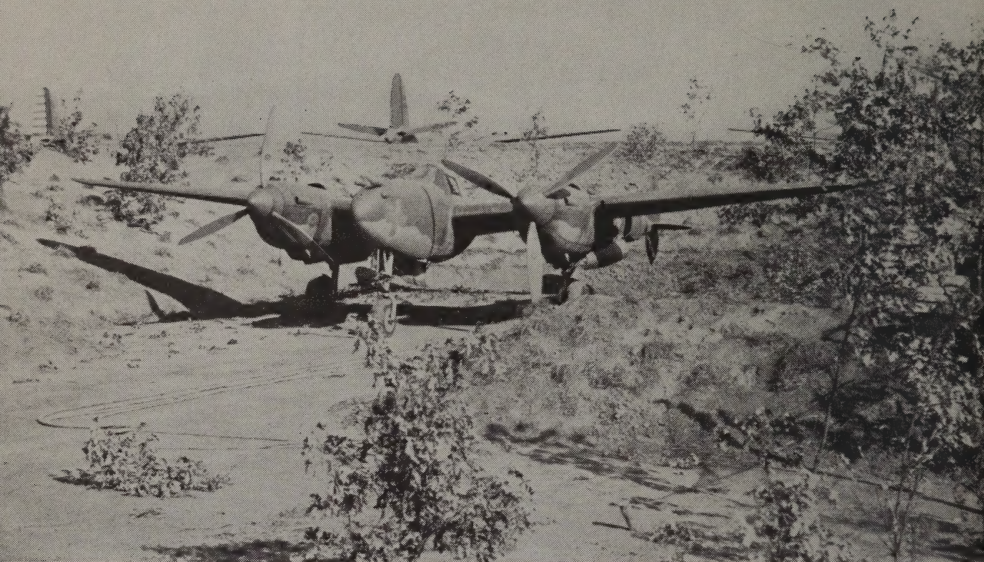


FIGURE 20.—*Revetments, whether sunken or built at ground level, give protection to planes but are difficult to camouflage. For best results, they should be camouflaged with flat-tops.*

nets alone, unless there is ample manpower available. Garnished flat-tops may be constructed over planes parked in revetments or in the open, but it is obvious that covering a bomber entails a large-scale structural task. Ordinarily, concealment will be by use of natural concealment and terrain features, with drapes, cut trees, and brush added, if necessary. Artificial materials will be used here only as a last resort.

PAINTING AND PATTERNS—The decision to use paint for camouflage of planes in a theater of operations, and the selection of patterns, are command functions of the Army Air Forces. Because planes are painted at the factories for service in widely different theaters, dull lusterless olive drab on the top and sides, with light-

er shading on the under surfaces, has been adopted as a reasonably satisfactory standard color scheme. But no method of painting aircraft for camouflage is wholly dependable against aerial reconnaissance. This is because when observed from above, the shadow of the plane and the reflection from its smooth surfaces, which tend to make it appear lighter than its background, reveal it for what it is. The shadow of the plane on the ground always remains an intense black.

Many considerations affect the value of camouflaging aircraft with painted patterns. If, for camouflage purposes, a second coat of paint is put on, its weight may be a liability from an operating standpoint. Many experiments with painted camouflage patterns have been made on aircraft

by foreign countries, but generally their use has been restricted to special theaters and for exceptional purposes.

In such cases it has been established that the best protective coloration that can be given a plane is to cover it with a pattern representing the background against which it will be seen. Light sand color, for example, is better adapted to desert country than olive drab. Many of the planes used for night bombing by the British are painted solid black.

The British have found that if stripes are painted on aircraft it is difficult to determine the type or distinguish the wing tips. Aircraft with dark end-stripes should be placed on a dark background, and those with light end-stripes on a light background.

REVTMENTS—Revetments are used extensively in theaters of operations. They are built in the United States only upon special authorization.

The construction of flat-tops over revetments follows generally the principles involved in ordinary flat-top construction. They may be used to cover the revetment completely, or may merely supplement natural concealment. In wood or like construction, considerations of major maintenance, such as engine changes, cannot be permitted to influence the height of the roof. The cover must be as low as possible to facilitate concealment.

Plants, trees, and grass should be planted in, on, and around revetments, and if time permits sod should be transplanted. A series of revetments should not be laid out along straight lines, nor prolonging the runway or other natural bombing runs.

EXCAVATION—Planes may be parked in excavations in hillsides or below the surface level of airdromes, but underground concealment of planes impairs operating efficiency and is inadvisable except in extraordinary



FIGURE 21.—*The simpler a dummy, the better, if it reproduces accurately the shadow of a plane.*

situations. Further, this type of construction is difficult. Approximately 250 pounds per square foot is the load estimate for support of normal vegetation, and large spans of from 60 to 150 feet are called for. The excavation must be well-drained; otherwise the depression becomes a sump. Equally, in case of a gas attack, it is a gas trap.

Where open excavations or cuts are made, flat-top covers should be constructed. Simple designs may be improvised in the field. When no cover is employed, the proper procedure is to get the plane wings close to the ground, then apply local materials under the wings and fuselage.

DECOYS—Decoys are part of the general camouflage plan. If destruction intended for real aircraft can be diverted to decoy planes, much material will be saved and time will be gained

for direct retaliation. The use of decoy planes is therefore one more solution to the problem of concealment. The decoys should be incompletely concealed. Any types used should be just obvious enough to draw fire, and the actual equipment should be as well hidden as conditions permit.

Another important consideration is the movement of decoys from place to place on the dummy field. This practice is intended to simulate normal operating procedure. Three-dimensional decoys can be moved. Flat ground treatment, however, requires alternate decoys to simulate movement. Some of them are covered with screens while others are left exposed, the whole layout being varied at intervals. In constructing all decoys, use only enough detail to guarantee realistic shadows on the ground.

FIGURE 22.

Seen from Above

Whether you are operating deep in the green jungles or far across barren waste, never forget hostile airmen above, spying on your movements and trying to pinpoint your new positions. If they succeed you become an exact, known target. The next supplement will discuss "The Aerial Viewpoint"—what the camera in the air can and cannot do to detect military activities after they have been camouflaged. Other articles will discuss "Camouflage Clothing and the Fighting Man" and "Air-drome Camouflage in the T/O."

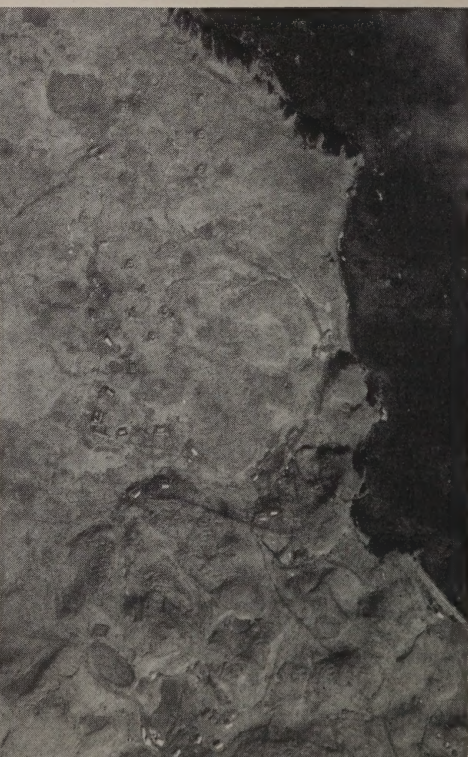




FIGURE 23.

CONCEALMENT of the INDIVIDUAL SOLDIER

The soldier's job is to stay alive to fight. He must be trained early and constantly in individual camouflage—one of the ways to stay alive.

Whether he calls it *camouflage* or something else, to each man at war camouflage means just this: a way to stay alive, to live to shoot and kill.

The jungle tiger or the mountain lion attends no lectures on individual concealment; he *lives* his lessons as he learns them. Each man's training in camouflage must begin as soon as

possible and that training must continue. It is too late to learn under fire. There will be no chance for the soldier to profit by his own mistakes. The result of a mistake in war is too final for that. The practice of camouflage and strict adherence to camouflage principles must become instinctive. It must be as much a part of each sol-

FIGURE 24.—Soldiers aren't chameleons, but they can take on protective coloration. If manufactured camouflage suits are not available, the job can be done in the field. A few bits of tape or cloth, a few dabs of paint—you'll find it worth the time it takes.



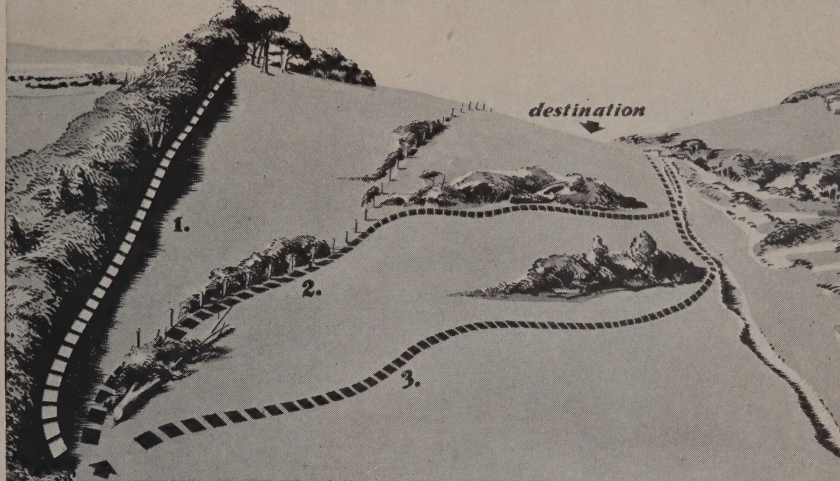


FIGURE 25.—Take route 1 when the chief danger is the aerial observer—trees give concealment, hill is crossed at top. Take route 2 in daylight when danger is from ground observation—seek cover of bushes, fence lines, and ditches, and avoid skyline. Take route 3 at night—avoid bushes and rough terrain to prevent noise and avoid skyline.

FIGURE 26.—①—Creep along fence lines and low vegetation—move slowly, silently.

②—Over open areas, sprint for next point of concealment—keep body low and follow zig-zag course.

③—Observe from bushes large enough to prevent becoming an obvious target—observe through or under low branches—make movements slowly.

④—If skyline cannot be avoided, crawl to it—approach crest slowly, using whatever concealment there may be—bring branches or brush with you if necessary.



FIGURE 27.—*Remember, the sun moves. What is at noon a protective shadow will in the evening be pale and useless.*

dier's daily life as sleeping, eating and breathing.

The individual must learn to be careful, resourceful, eternally vigilant. His camouflage measures are simple but can be extremely effective. He has no elaborate materials to work with. He has little time to conceal himself, especially when he is moving and must continue to move. But he has his hands, his uniform and equipment, his surroundings, and his brain. That is all he needs.

When a man is trained in scouting, patrolling, and sniping, he is trained in the art of individual camouflage;

he becomes an effective soldier. The camouflage he learns is as important as any other knowledge necessary to life. It is common sense applied to two kinds of action; preparing for the job; and using the terrain.

The enemy will be watching closely, trying to see through our measures of individual concealment. He has been trained to detect forms that are not immediately obvious. But if a helmet, for example, is disruptively painted or covered with colored cloth or bush, the eye will ordinarily fail to recognize the visible segments as a helmet, and will not be warned.

FIGURE 28.—*Avoid sharp, regular lines when observing. Scout on the left is a conspicuous target. Choose shaded area with irregular edges. Scout on the right is in shadow and well concealed.*



3 WAYS TO STAY ALIVE

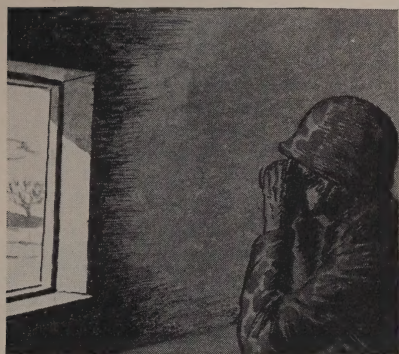


FIGURE 29. *RIGHT: When within a building, stand back from the windows—observe from shadows.*



FIGURE 30.—*RIGHT: When observing, keep in shadow, and use available natural concealment.*



FIGURE 31.—*RIGHT: On dry ground, muzzle blast will kick up dust—fire over grass, shrubs, or rock.*

...AND 3 WAYS NOT TO



FIGURE 32.—*WRONG: Avoid rocks unless they offer the only concealment—a rock hit with a bullet shatters.*



FIGURE 33.—*WRONG: Heavy shadow is not always concealing—avoid contrasting backgrounds.*



FIGURE 34.—*WRONG: You can do this only once in a battle—stay off that tell-tale skyline!*



FIGURE 35.—*At night sound is the revealing signal. Move carefully, keep close to the ground.*



FIGURE 36.—*To cover an unavoidably noisy movement, watch for the light of a shell burst—then act swiftly during the noise which follows.*

When equipping himself for the job of fighting, the soldier's first step is to break up his outline or form. This may be done by wearing one of the disruptively-colored camouflage suits now issue for jungle or arctic use; by painting fatigue uniform and canvas equipment; by attaching twigs, grass, and colored cloth to the helmet and clothes; by darkening the light color of the face.

The basis of all secrecy in movement is constant use of background. The soldier must be taught the danger of exposing his silhouette against light or any contrasting surface

against which he will stand out. He must learn to find and use natural shadows. He must know the advantages of dispersion. He must be aware of the danger of the slightest movement in a motionless terrain.

Under most circumstances, training a soldier in individual concealment protects his entire unit. A man who has learned to avoid the things that betray his own presence also has developed that care and awareness so necessary for maintenance of camouflage discipline in an entire unit. There the carelessness of one man will reveal the presence of the whole outfit.

FIGURE 37. — *In moonlight, the shadows are like day shadows. They can be your friends or your enemies. Stay in the shadows, and the hostile observer will be in the dark about your location.*



FIGURE 38.—*If you are caught exposed in the light of a flare, freeze. Do not look up. The moment the flare goes out, dash for cover—the enemy is momentarily blinded.*



FIGURE 39.—*The night isn't a protective blanket. You can see at night. Take it for granted that the enemy can too. Within half an hour in the dark, the eye adjusts itself fully for night vision. A silhouette is always black against the sky. Use the concealment of low ground at night, but remember that on a bright night a light road or river bed will reveal your outline.*





FIGURE 40. (a) and (b)—When cover over foxhole is not practicable, because of anti-aircraft mission or lack of time, sod the parapet and arrange natural material to lean in over foxhole—or hide all spoil under convenient concealment. Compare with unconcealed foxhole on left. Attach natural materials to helmet.



FIGURE 41. (a) and (b)—These photographs show the effectiveness of covering foxhole with overhead screen, when practicable, as compared to an unconcealed foxhole.

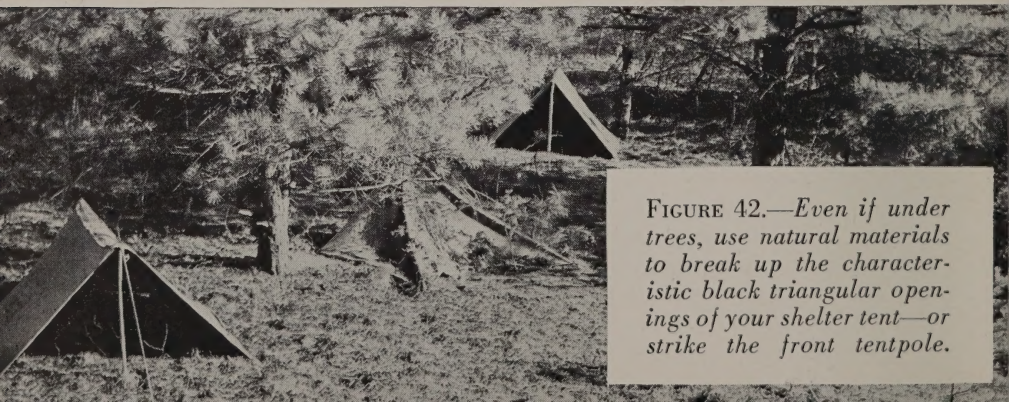
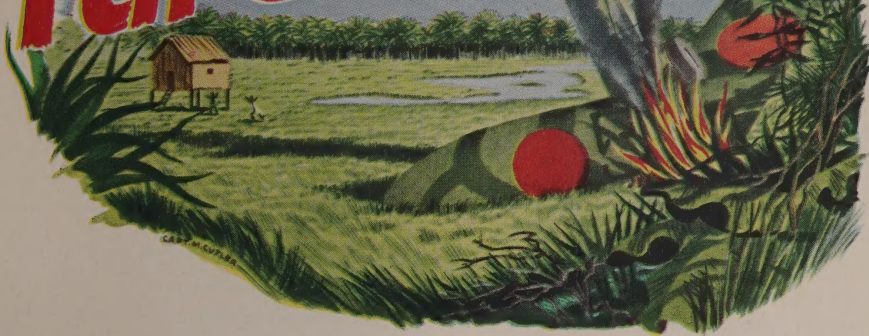


FIGURE 42.—Even if under trees, use natural materials to break up the characteristic black triangular openings of your shelter tent—or strike the front tentpole.

FROM THE

Far East



The accompanying notes have been abstracted from reports received from overseas, including "Fighting on Guadalcanal," "Recent Overseas Camouflage," and interviews with officers returning from battle areas. Overseas practices should not be applied to new conditions without careful consideration of differences in terrain pattern, climate, and availability of materials.

PHILIPPINES—" . . . Do not distort the natural vegetation. Be careful of making roads and trails to military objectives. If any distortion is necessary, make false constructions, such as tree stumps, on your field; a couple of small shacks mounted on runners or wheels in the middle of a field also serve their purpose. Netting to match the surroundings is almost indispensable in covering aircraft. If the enemy can't find you they can't hurt you."

GUADALCANAL—"The biggest thing I have learned since I hit Guadalcanal is that the Japanese camouflage is miles ahead of ours. Their individual can camouflage himself a lot better than ours. We must practice and train in this . . ."

CELEBES—" . . . There are small clumps of trees left in the middle of the field and it is very easy to camouflage the entire establishment. Therefore, if we ever prepare to retake Kendari, it will require much careful reconnaissance before the preliminary air assault. . . ."



FIGURE 43.



FIGURE 44.

BATAAN—" . . . It is essential that personnel operating guns be extremely careful when in and around emplacements so as not to leave telltale paths or marks of any kind. . . . In moving of portable camouflage, it is essential that it be done rapidly and replaced promptly, so as not to disclose a target to the enemy. . . . Experience has proven that the well-camouflaged aircraft is never seen, even by attempted detection through photography. . . ."

JAVA—"Camouflage work done by the Dutch was quite effective, for nothing but dummy airplanes and dummy gun installations were ever bombed on our field. . . ."

GUADALCANAL—" . . . We insist on overhead cover for foxholes because of the Japanese mortar fire. In doing this you have to guard against the men building these foxholes up too high above the level of the ground. . . ."

NEW HEBRIDES (Advanced Field)—"Lessons learned from Pearl Harbor were put into effect here, and explicit instructions were given to us from the CO at Pearl Harbor to utilize camouflage, dispersion, and natural cover, since Marine Air Field at Pearl Harbor, where they did not practice dispersion or camouflage, was badly damaged during the attack there on December 7th. Runway and gun-emplacements sites were selected mainly from air reconnaissance. A seaplane was used during construction to check visibility of work and determine corrections necessary. Dispersion and use of natural cover were thoroughly planned. Camouflage discipline was carefully maintained. A program of



FIGURE 45.

transplanting and landscaping was initiated to preserve natural appearance as much as possible. Construction scars were immediately sodded."

"Roadways through area were one-way, about 8 feet wide, and well drained. This type did not disturb existing overhead cover and could not be seen from the air.

"Runways about 350 feet wide, including taxi-strips, were cut through a growth of 40- to 50-foot coconut trees. Terrain conditions made a runway difficult to see at a distance. We experienced difficulty with dust from the white coral surface of the runways when weather was dry, and we had no material for binding. Steel landing mats were very handy in warm-up areas to hold the runway surface in place. No buildings or other installations were constructed less than 150 feet from the runways or taxiways, because the Japs have a habit of strafing sides of runways during attack.

"Concealed artillery was ordered not to fire unless attacked. The Jap trick is to send reconnaissance planes over suspected AA emplacements hoping to draw fire, learn the position, and take photos. This has been an effective stunt in some other areas and proved fatal for the guns concerned.

"I do not believe the Japs ever knew the location of this base because



FIGURE 46.

it has never been attacked, although it is within flying distance of Guadalcanal and very active. Eighteen fighters normally used the base but we had as high as 140 there at once.

"As soon as the main field was constructed, auxiliary fields were picked out. These were located at least 5 miles apart. If any attack was made on the main airfield, these fields would be available for any aircraft in the air. We also used these auxiliary fields, as soon as they were ready, for dispersing any additional aircraft that might come in during operations."

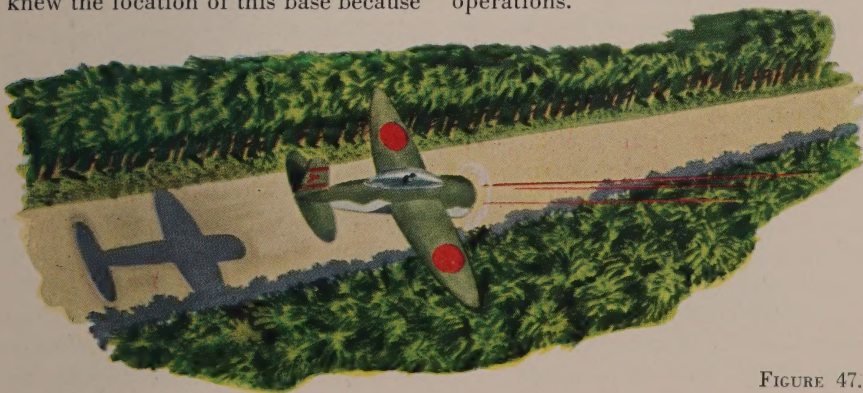


FIGURE 47.



NETS AND NETTING

There is a net designed for that job you have to do. Know its characteristics, so that you can use (or copy) each net to best advantage.

When manufactured coverings are required for concealment of equipment, weapons, or supplies, the time-honored fish net and chicken wire, garnished with burlap strips, are no longer the only camouflage materials available for this purpose. The fishing industry's diagonally woven net and the poultry farmer's hexagonal-mesh wire have been redesigned especially for camouflage use; burlap has been supplemented by other types of fabric and by totally different garnishes. Experiments and tests have proved that successful concealment of vital material can be achieved with a multitude of different coverings.

Each type of covering has characteristics which make it useful for one purpose or another. Some nets weigh less than others and are suitable for stowage in aircraft; wire netting does not sag or deteriorate with use, and is intended for use at stabilized positions or large installations. To a great extent, choice of materials depends on the particular situation in which they are to be used. Selection of netting materials is no exception to the rule that the camouflage officer must combine skill with ingenuity.

Nets used for screening are of two basic types. Closely woven nets re-



FIGURE 48.—Unrolling pregarnished chicken wire netting for a flat-top. The garnishing is burlap strips.

quire no garnishing to provide concealment, but they form a veil which masks equipment hidden under them, breaking up its form, dulling its brightness, and throwing irregular shadows over it. Open-weave nets, on the other hand, serve merely to support the garnishing which serves the same purpose of concealment. A closely woven net without garnish can disguise the identity of the object it conceals; but a fish net with $2\frac{1}{4}$ -inch mesh openings is no magic veil by itself, and conceals nothing unless it is garnished.

In the new T/BA's for most branches, shrimp nets closely woven of cotton fabric, with mesh openings of from $\frac{1}{4}$ to $\frac{5}{16}$ inch square, are included. A shrimp net is also provided in the stowage list of each combat vehicle, forming a basic item of

the vehicle's equipment. The shrimp net, like the garnished twine net, when used as a drape affords effective concealment, particularly in the desert. It cannot be employed as a flat-top with any degree of success, since it is not easy to stretch flat; nor does it provide the necessary thinned-out edges. The shrimp net is fire-proofed and treated to be effective against detection by aerial photographs made with infrared film, which distinguishes between growing



FIGURE 49.



FIGURE 50.

SHRIMP NET being used as a truck drape. Notice shape has been purposely distorted.

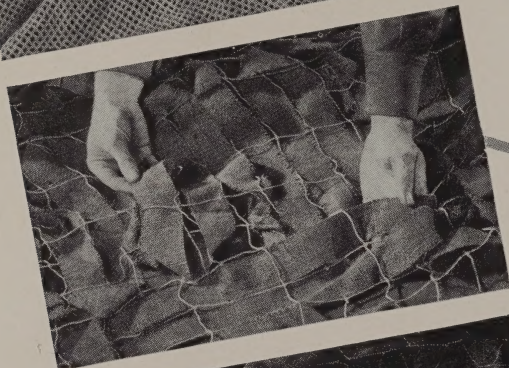


FIGURE 51.

TWINE NET being used to conceal an airplane. The garnishing has been woven by hand.



FIGURE 52.

CHICKEN WIRE, pre-garnished, used on permanent flat-top over 155-mm gun in revetted hillside emplacement.

and artificial material. It is supplied in two colors, sand and olive drab, or may be readily sprayed with paint in a disruptive pattern if the terrain so indicates. The sand color blends into desert terrain or dry summer foliage, while the olive drab is a basic camouflage color, merging into most natural backgrounds.

Other close-weave nettings, to be used as drapes in the same fashion as shrimp nets, are expedients only.

SCRIM, fabric similar to mosquito netting in weave and appearance, ap-

pears to make an effective camouflage drape. Its use is particularly indicated for aircraft, since any of the materials (there are several) which fall under the heading of scrim are light in weight, exceptionally strong, and easily handled. Scrim may easily be painted disruptively; one experiment has shown that two different designs in two diverse color schemes can be executed on the same net, one on either side. In this way a scrim net may serve for concealment of a plane based at one field,



FIGURE 53.

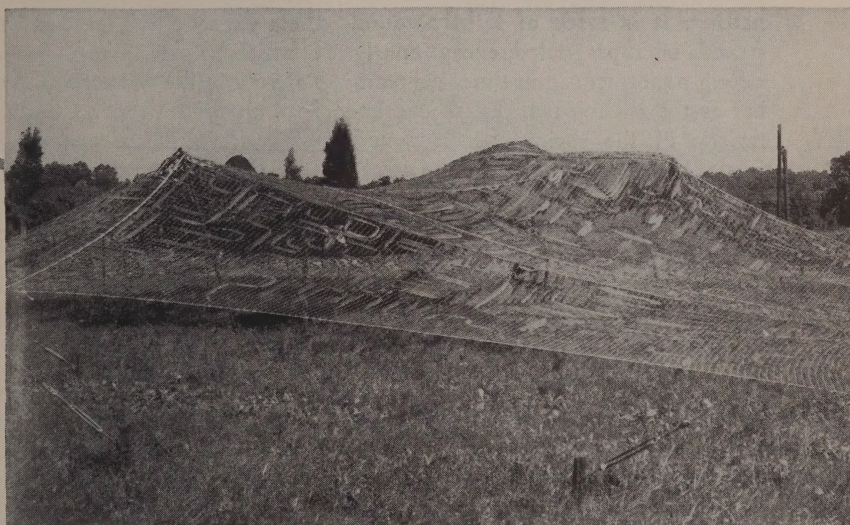


FIGURE 54.



FIGURE 55.

and then be carried in the plane to another field of entirely different character, where it is reversed to fit into the new surroundings. Aircraft operating between desert country and a jungle landing field would thus carry a scrim net painted predominantly sand color on one side, jungle green on the other.

No scrim material is at present stocked in engineer depots. Theatrical supply houses, textile manufacturers, and merchants are usually sources for this material.

WOVEN PAPER netting is a material similar in appearance to shrimp netting. It is made of tightly-wound strands of impregnated, exceptionally strong paper, woven in the same manner as the shrimp net. Every characteristic of the shrimp net is found in paper netting except that of great strength.

The situation for the supply of this netting is much the same as for scrim. Manufacturers of onion-sacking materials and the like are commercial

sources. One such material that has been tested is called "visinet," a name which has been applied incorrectly to all paper nettings.

THE TWINE NET, commonly called fish net, is the most widely known open-weave camouflage covering material. It is woven of tarred and chemically treated seine twine, known as No. 18 (meaning 18-thread) medium laid. This diagonally woven net originated with the fishing industry. The new net is cut obliquely, and taped around the edges in such a way that the meshes pull out square.

Tension from any one side pulls them straight and there is little tendency, therefore, to sag. It is a cardinal rule in the proper construction of flat-tops that they be taut and flat, eliminating any internal identifying shadows.

It cannot be repeated too often that open-weave nets are of no camouflage value unless they are *properly garnished*. The twine net has $2\frac{1}{4}$ -inch square openings, which are

FIGURE 56.—*Thinning garnishing at edges of net to blend with background.*



merely a series of open holes, concealing nothing when ungarnished. Garnishing materials and methods are discussed below. Twine nets are supplied pregarnished with fabrics, in several color combinations suitable for summer, winter, or desert use.

They serve either as camouflage drapes or flat-tops. The alternation of garnishing with open spaces provides the necessary roughness or texture, irregular shadows, and shine-dulling characteristics of a camouflage covering, whether the net is used as a drape or a flat-top. It is characteristic of twine nets that they shrink when wet and expand when they dry out.

This expansion and contraction require constant maintenance when they are used as flat-tops. With a well-made wire frame, twine nets are capable of supporting considerable snow loads and will stand up against adverse weather conditions. They are fire-resistant, light, and easily handled.

STRAIGHT-LINE WIRE NETTING, commonly called chicken wire, and actually a development of this material, is an open-weave camouflage screening material used for permanent installations such as large flat-tops and other screens. Again, this netting is useless if not properly garnished. Because it is both bulky and stiff, it cannot be employed successfully as a drape. In mounded or sloped screens, however, wire netting is the best covering material since, once "molded" to a frame's shape, it will hold that shape indefinitely. The wire is rust-resistant and, of course, fireproof to gun flashes.

In addition to being available in ungarnished rolls, this wire is also pregarnished with either fabric or steel wool, both in various camouflage colors.

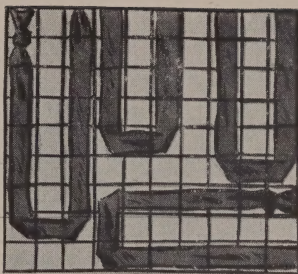


FIGURE 57.—The U-pattern is quickly woven. Near the ends of the pattern the open ends are always pointed out.

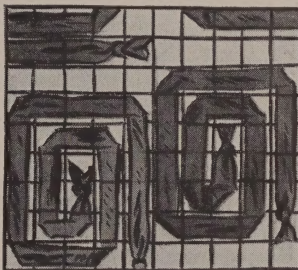


FIGURE 58.—Fabric strips are woven in square spirals to make the Greek Key garnishing pattern.



FIGURE 59.—Weaving strips into a camouflage net.

Various types of chicken wire may be used if available locally. Notable among them is 1-inch mesh hexagonal chicken wire upon which chicken feathers may be applied as a garnishing material. They are attached to the netting with an adhesive prior to issue. Ordinary chicken wire with larger mesh may be employed as field-garnished camouflage netting.

WELDED-WEB WIRE is a light, straight-line exceptionally strong netting which is pregarnished with either steel wool or glass wool. It is easier to unroll and make flat than straight-line wire; otherwise its characteristics and advantages are similar. It must be garnished to be of any use. Fabric cannot easily be used as a garnishing material on welded wire because of the more open weave, which necessitates stapling the fabric to the wire, rather than tying it on.

Apart from garnishing materials not within the scope of this article, there is a great variety of manufactured items available, either issue or locally obtainable.

CLOTH GARNISH is the most common type, used with either the twine net or wire netting. The standard garnish strip, cut in the field or furnished on nets already garnished, is 60 inches long and 2 inches wide. Two types of cloth are items of issue for this purpose, but almost any cloth obtainable locally through salvage of old clothes, uniforms, or canvas will do equally well. Burlap is the most familiar issue type; osnaburg is a substitute of equal effectiveness. Both are issued in the standard camouflage colors and in black and white. Pregarnished nets are issued in suitable blends of these colored fabrics for summer, winter, or desert use. (See table at end of this article.)

There are a number of effective methods for weaving cloth garnishing

on nets, but the simplest patterns are the best. They save time, are more easily applied, conserve material, and the basic over-all design is easier to control. An irregular, more or less star-shaped area is to be sought when the net is garnished completely; it should have a maximum of 80% coverage in the middle, thinning to 10% at the edges in the case of flat-tops, and to about 50% in the case of drapes. Particular care must be taken to avoid indicating the rectangular shape of the net by heavy garnishing in the corners. Many weaving methods, such as those outlined below, allow attainment of correct design without confusion in following its progress.

The most simple are the straight-line pattern and the self-explanatory U-pattern. The former is particularly effective for desert drapes, where no thinning-out is necessary. In weaving to the U-shape, the pattern is kept irregular. As the garnishing approaches the edge of the net, the strips are woven so that both ends, still following the U-form, point toward the edge of the net and are not parallel to it.

The Greek Key pattern is widely used, and may be mastered quickly. Strips of the garnish are woven parallel to the sides of the net in a squared spiral or fretwork design. The spiral may be variable in shape, but no strips cross one another, and the principle of weaving remains constant.

Usually it is a waste of material and of no particular benefit to allow ends of the strips to hang down. They are better tied to the net.

STEEL WOOL and **GLASS WOOL** when used as garnishing materials are supplied already stapled to wire netting. The steel wool has an inherent texture which defeats close inspection from hedge-hopping planes, since it

presents an appearance closely resembling grass. Its usefulness is most apparent where there is a fire hazard. It is rustproofed, then painted in most of the camouflage colors, as indicated in the adjoined table. Glass wool has very much the same characteristics and in addition is soft, pliable, and of great durability.

FEATHERS can be procured in large quantities in most sections of the world and make an excellent garnishing material to be supported on wire netting. Farms, poultry establishments, mattress and pillow factories, and upholstering plants are sources of supply.

An adhesive (usually a bituminous emulsion or other asphalt-base product) is used to bind the feathers to the wire. In the field, the dip method is the most practical for applying this adhesive. The wire netting is passed through a trough, where it is coated completely with the adhesive. The feathers are then spread over the dipped netting.

PAPER GARNISHING has been experimented with. It can be used like cloth, but is neither as durable nor as strong, and for that reason has not yet been standardized.

Other garnishing materials may be encountered in certain theaters of operation. Coarse seaweed is spun into fibres and then stapled to wire mesh, as in the case of steel or glass wools. When used in moist climates, these seaweed fibres are very elastic and durable, but they soon become brittle under dry conditions. Vegetable fibres such as sisal or the hemp-like tula may be treated and shredded, then stapled to wire mesh in much the same fashion. They are tough, hard, and durable, but are highly inflammable. Like seaweed, they are generally used in foreign countries.



FIGURE 60.—*Chicken-feather garnishing on chicken wire. Feathers are held on by an adhesive.*

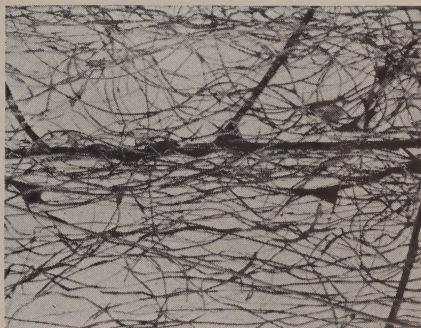


FIGURE 61.—*Steel wool garnishing on chicken wire. Steel wool is spread out in a thin layer and stapled to the chicken wire. (Photograph full size.)*

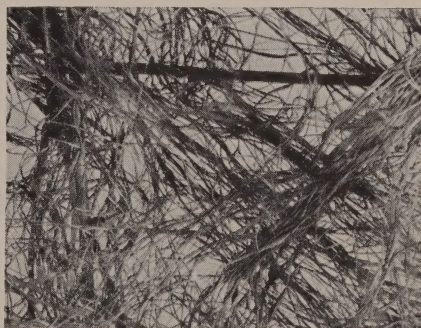


FIGURE 62.—*Glass-wool garnishing on welded-wire mesh. This is applied like steel wool. (Photograph full size.)*



ISSUE NETS AND NETTING

NETS, SHRIMP, COTTON	Weight	Cubic Ft.	Colors
22' x 22'	30 lb.	2.0	olive drab, sand
29' x 29'	55 lb.	3.5	olive drab, sand
36' x 44'	100 lb.	5.5	olive drab, sand
45' x 45'	125 lb.	6.0	olive drab, sand

NETS, TWINE, Fabric-Garnished.

15' x 15'	9 lb.	0.9	desert, summer, winter*
14' x 29'	12 lb.	1.0	desert, summer, winter*
17' x 35'	20 lb.	2.0	desert, summer, winter*
29' x 29'	27 lb.	3.33	desert, summer, winter*
36' x 44'	51 lb.	5.0	desert, summer, winter*

NETTING, WIRE, Steel Wool-Garnished.

6' x 75' roll	100 lb.	6.4	dark green, light green, earth brown, olive drab, field drab, sand.
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NETTING, WIRE, Glass Wool-Garnished.

6' x 75' roll	(about same as with steel wool)	(about same as with steel wool)	(same as steel wool)
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NETTING, WIRE, Fabric-Garnished.

6' x 150' roll	95 lb.	5.5	(same as steel wool)
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CLOTH

Impregnated, 2" wide, 300' rolls	in light green, dark green, sand, field drab, earth brown, earth yellow, loam, earth red, olive drab, black, and white.
----------------------------------	--

CLOTH

Impregnated, 40" wide (osnaburg, burlap)	olive drab, uncolored; also sand (proposed).
--	---

NETTING, WIRE

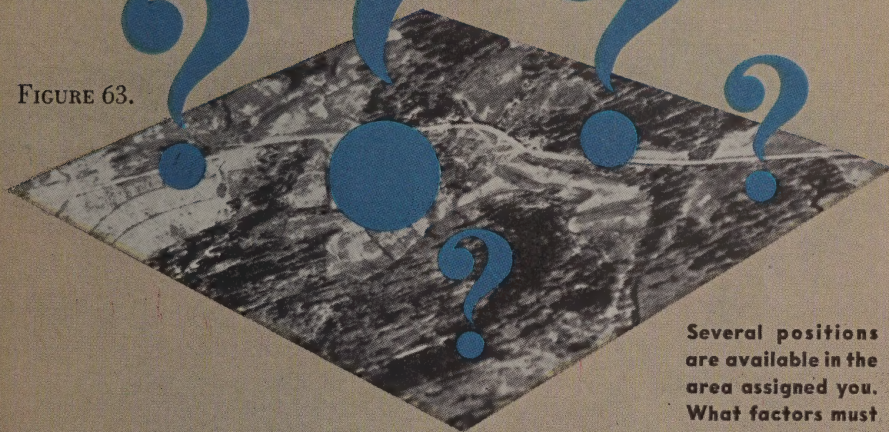
Straight-line Weave, Ungarnished—6' x 150' roll

* DISTRIBUTION, of Colored Garnish Strips in Blends:

Summer	Winter	Desert
15%—light green	60%—earth brown	10%—light green
70%—dark green	10%—earth red	80%—sand
15%—field drab	30%—olive drab	10%—olive drab

Choice of Position

FIGURE 63.



Several positions are available in the area assigned you. What factors must you consider?

If military personnel, installations, and equipment can be located in places where they are hard to see, they will be easier to conceal. This is axiomatic. It is often said that "Choice of position is half the job of concealment." Some of the principles to be observed in choice of a position are illustrated by the examples on pages 36 and 37.

First and most important consideration is your mission. Occupying troops must be disposed so they can operate to best military advantage and accomplish what they have set out to do. It is to be expected, consequently, that it may often be necessary to compromise in favor of mission when selecting concealment.

Since personnel and vehicles must find easy access to the position selected, this consideration is second

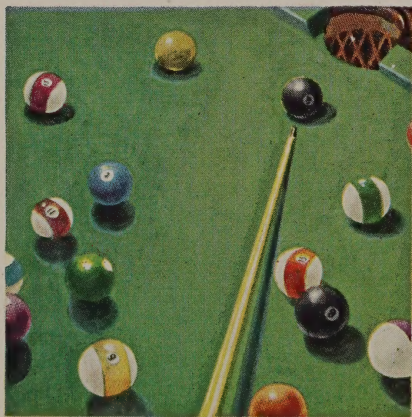
only to mission. It is desirable that personnel and vehicles should be able to reach the position without making paths and telltale tracks, either before or during occupation of the position. Unavoidable new tracks should be obliterated carefully at the first opportunity. Whenever possible, new tracks should follow existing roads, contours, and hedges or shrubbery.

All the possibilities of natural concealment should be exploited when a position is being chosen. The concealment value of trees, rocks, buildings, shadows, and irregular ground patterns should be used. Look for existing defilade to escape enemy observation — both ground observation and low-oblique aerial observation. At all times guard against any changes in terrain that may be noticed and betray your presence.

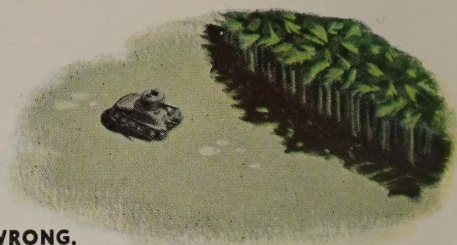
FIGURE 64.—There are two dice in this picture. One is easily seen against the plain area of the rug—the other is hardly noticed against the pattern.



FIGURE 65.—The cue, serving as a reference point, leads your eye to an 8-ball—another in the picture escapes attention.

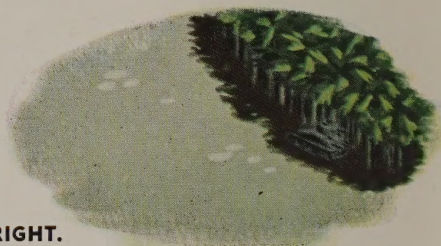


Terrain Features



WRONG.

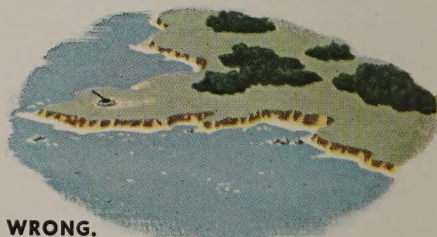
①—In open, smooth terrain—an easy target.



RIGHT.

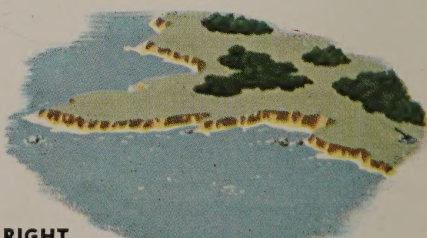
②—Concealed by shadows and broken patterns.

Avoid Landmarks...



WRONG.

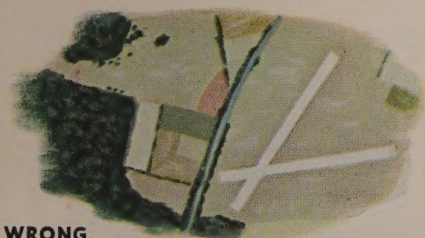
①—The peninsula—and the gun—easily found.



RIGHT.

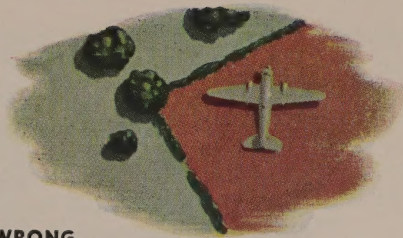
②—Locate guns far as possible from landmarks.

Should be Utilized for Concealment



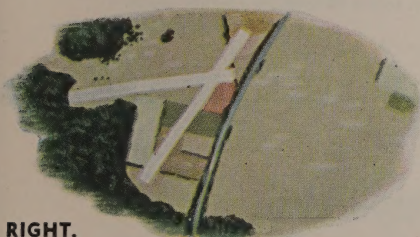
WRONG.

③—Runways like this are easily identified.



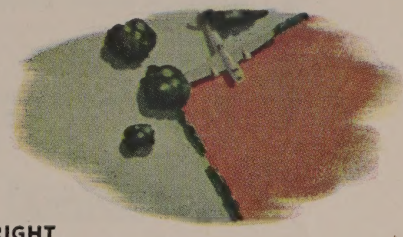
WRONG.

⑤—A plane shadow on ground is distinctive.



RIGHT.

④—Runways can be blended with the terrain.



RIGHT.

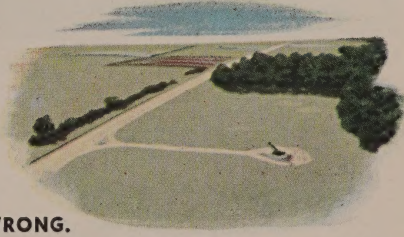
⑥—Use bushes, hedgerows to break shadows.

they are the Enemy's Reference Points



WRONG.

③—Lone trees are landmarks—and dangerous.



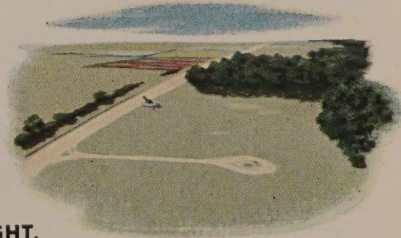
WRONG.

⑤—Tracks, like the cue, lead to an objective.



RIGHT.

④—Locate bivouacs in woods or clumps of trees.



RIGHT.

⑥—Avoid "pointers" that may be suspected.

HAVE YOU SEEN THE NEW CAMOUFLAGE FILMS?

The first four training films described below are in technicolor, with sound commentaries by Lowell Thomas. The fifth, also with sound track, was made in England and with TF 5-649 should be shown to troops before the others. These films may be obtained through the sublibraries at your post, camp, or station, which can procure them, if they are not on hand, from the central distribution library of your Service Command. When you requisition them, be sure to specify whether you need 35-mm or 16-mm films.

Individual Concealment



FIGURE 66.

TF 5-645.—The action of a combat patrol out to destroy an enemy machine-gun position. Preferably shown just before field exercises in broken terrain, it dramatically illustrates how an individual soldier can make himself a vague and elusive target when moving under fire. For all troops being trained in combat tactics. (10 minutes.)

The Bivouac Area



FIGURE 67.

TF 5-646.—Occupation of a combat-zone bivouac. Should be seen by troops before their first bivouac, to familiarize them with procedures indispensable in maintaining the secrecy of their position. Also a reminder to officers and NCO's of their responsibilities for planning and enforcing camouflage discipline. (10 minutes.)

Use of Artificial Materials



FIGURE 68.

TF 5-648.—Instructional material directly intended for Artillery and Armored Force, but valuable to all personnel of crew-served weapons and operators of vehicles equipped with camouflage nets. Includes construction and garnishing of a net; how to fold it; use of net as drape over a light tank; erecting a 36 x 44-foot flat-top with a quickly opened embrasure. (20 minutes.)

Camouflage Principles

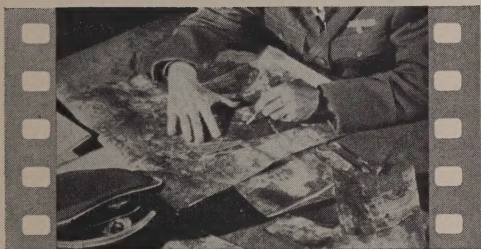


FIGURE 69.

TF 5-649.—Fundamental camouflage training for all branches of the service. An introduction to hostile ground and aerial observation; includes aerial photography, protective considerations in the choice of positions, concealment precautions, and simple ways and means of facilitating concealment by use of natural and artificial materials. (10 minutes.)

Camouflage for All Arms

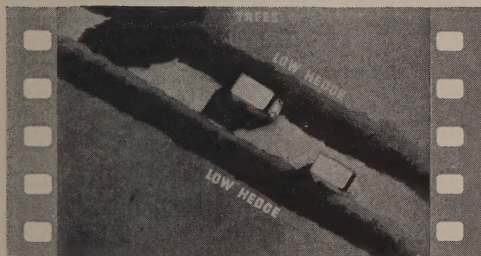
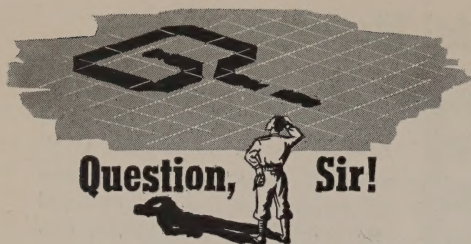


FIGURE 70.

TF 5-961.—An excellent orientation film made by the British, now adopted for Army distribution here. Lays dramatic emphasis on the necessity for concealment in modern warfare. Surveys basic methods of concealing individuals and vehicles. (30 minutes.)



We have some trouble with drapes over our trucks because the buckles on the canvas tops snag the drapes. Can this be avoided?

If it does not interfere with their use the buckles can be quickly wrapped in rags or tape, for protection of drapes.

Where can I obtain camouflage training films for instruction of my units?

If you are in a theater of operations, your request must go through a tactical chain of command. See pages 38-39 for a description of these films and directions for obtaining them in the United States and territories.

Is an issue dye available for darkening faded web equipment?

Yes. This dye is OQMG No. 3, Compound for Coloring Web Equipment. It is available through unit and post quartermaster property officers on requisition.

Is there any way to prevent posts of flat-tops from pushing into soft ground when anchor wires are racked?

Use footings or flat plates under posts.

Can decoys be used effectively in mine installations?

Yes. Obviously camouflaged decoy road blocks are often as effective as real installations in forcing vehicle drivers to stop and investigate. Sometimes it is enough to dig a series of circles in the ground or road surface, in a recognizable mine-field pattern.

What size drape is right for a glider? What size over an AA prime mover?

Use two 29 x 29-foot drapes fastened together for the glider; and one 36 x 44-foot drape over prime mover.

How do you lay out camouflage patterns on large areas?

Preferably you should design your patterns on scaled plans or elevations. Then the patterns can be laid out full size, with chalk, sand, or paint, on the ground or building surfaces. A 10- to 15-foot grid is a helpful guide for irregular patterns. A sprinkling can with one hole in the spout is a good device for marking with paint on roofs or ground areas.

How much snow will an ordinary flat-top carry?

Snow should be partly shaken off when it is about one inch thick. The usual flat-top is a fair-weather structure and must be tended carefully when there is snow or sleet, to prevent sagging of net and displacement of stakes.

[A.G. 062.11(3-5-43).]

BY ORDER OF THE SECRETARY OF WAR:

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

G. C. MARSHALL,
Chief of Staff.

DISTRIBUTION:

X

(For explanation of symbol see FM 21-6).

